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PTO/SB/05 (2/98)
Approved for use through 09/30/2000. OMB 0651-0032
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	RS50
First Inventor or Application Identifier	R S SMITH
Title	A RECIRCULATING MEDIUM TURBINE
Express Mail Label No.	

APPLICATION ELEMENTS
See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

1. ☒ * Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original and a duplicate for fee processing)
2. ☒ Specification [Total Pages 19] (preferred arrangement set forth below)
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings (if filed)
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 2]
4. Oath or Declaration [Total Pages 2]
   a. ☒ Newly executed (original or copy)
   b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d)) (for continuation/divisional with Box 17 completed) [Note Box 5 below]
      i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference (useable if Box 4b is checked) The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered to be part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Microfiche Computer Program (Appendix)
7. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
   a. ☐ Computer Readable Copy
   b. ☐ Paper Copy (identical to computer copy)
   c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. ☐ Assignment Papers (cover sheet & document(s))
9. ☐ 37 C.F.R.§3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☐ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
14. ☐ * Small Entity Statement(s) (PTO/SB/09-12) ☐ Statement filed in prior application, Status still proper and desired
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☐ Other: ....

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17. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☒ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: ______/______

Prior application information: Examiner ______ Group / Art Unit: ______

18. CORRESPONDENCE ADDRESS

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Country		Telephone		Fax	

Name (Print/Type)	ROBERT S. SMITH	Registration No. (Attorney/Agent)	31305
Signature	Robert Samuel Smith	Date	10-24-00

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Patent fees are subject to annual revision on October 1. These are the fees effective October 1, 1997. Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12. See 37 C.F.R. §§ 1.27 and 1.28

TOTAL AMOUNT OF PAYMENT ($) 355.00

Complete If Known	
Application Number	
Filing Date	
First Named Inventor	[illegible] R SMITH
Examiner Name	
Group / Art Unit	
Attorney Docket No.	[illegible] R530

METHOD OF PAYMENT (check one)

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☐ Charge Any Additional Fee Required Under 37 C.F.R. §§ 1.16 and 1.17

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	790	201	395	Utility filing fee	355.00
106	330	206	165	Design filing fee	
107	540	207	270	Plant filing fee	
108	790	208	395	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 355.00

2. EXTRA CLAIM FEES

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X		=	
Independent Claims		-3** =		X		=	
Multiple Dependent						=	

**or number previously paid, if greater. For Reissues, see below

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	22	203	11	Claims in excess of 20
102	82	202	41	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	82	209	41	** Reissue independent claims over original patent
110	22	210	11	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	400	216	200	Extension for reply within second month	
117	950	217	475	Extension for reply within third month	
118	1,510	218	755	Extension for reply within fourth month	
128	2,060	228	1,030	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,320	241	660	Petition to revive - unintentional	
142	1,320	242	660	Utility issue fee (or reissue)	
143	450	243	225	Design issue fee	
144	670	244	335	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	790	246	395	Filing a submission after final rejection (37 CFR 1.129(a))	
149	790	249	395	For each additional invention to be examined (37 CFR 1.129(b))	

Other fee (specify) ______

Other fee (specify) ______

* Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($)

SUBMITTED BY			Complete (if applicable)	
Typed or Printed Name	Robert S. Smith		Reg. Number	31305
Signature	Robert S. Smith	Date Oct 20, 2000	Deposit Account User ID	

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A RECIRCULATING MEDIUM TURBINE

FIELD OF THE INVENTION:

This invention relates to turbines and particularly to a turbine in which the liquid medium is partially converted to vapor which propels liquid against a vaneless turbine.

BACKGROUND AND INFORMATION DISCLOSURE:

Turbines, defined to be a system where the momentum of fluid stream is directed against rotatably mounted vanes, have been in existence for thousands of years in one form or another.

In modern form, a turbine typically includes a combustion chamber for generating a high pressure volume of gas, a nozzle having a converging-diverging channel which shape converts the energy of a gas stream emerging from the combustion chamber from having a large potential component, (large pressure) to having a large kinetic component and a rotating vane section against which the high velocity stream is directed to transfer the kinetic energy of the gas to the rotational energy of the blades.. The increase in the kinetic component (increased velocity of the gas stream) is accomplished in the nozzle by passing the gas from an entry section having a large sectional area through a convergent area having a smaller sectional area.

When effectively most all of the conversion from potential to kinetic energy takes place in one "stage",(i.e., one rotating wheel energized by one nozzle,) the turbine is said to operate by "impulse" and the turbine is therefore known as an impulse turbine.

A limit to efficiency of an impulse turbine is imposed by a property of the gas media when a certain "critical pressure", drop across the nozzle is exceeded, then the volume of discharge of gas through the nozzle is constant in spite of increasing ratio of inlet pressure to outlet pressure. Consequently, there is an inherent limit to the amount of energy that can be extracted from the flow of the gas through a nozzle that converts potential to kinetic energy.

In order to overcome this natural limitation, the "reactive" turbine has been developed which includes a gang of nozzle-turbine stages all operating in series. With each stage, the gas stream is subject to a succession of potential to kinetic changes accompanied by successive reduction of energy of the stream so as to extract a maximum total energy from the gas stream before discharging the gas stream to the environment.

Each stage of the reactive turbine includes a stationary section which functions as a nozzle in converting pressure to velocity and a rotating section which converts some of the kinetic energy of the gas stream to kinetic energy of the respective rotating section.

The reactive turbine inherently has a limited efficiency due to losses of energy arising from turbulence of the high speed stream passing through the rotating section and frictional

losses of the gas stream passing across the walls of the "stationary" section. The loss of energy due to friction with stationary surfaces increases with the number of stationary sections.

The typical rotating section of the turbine includes blades against which surfaces the gas stream is directed causing the wheel to which the blades are attached to rotate. If a gas molecule, travelling at high speed with a velocity component parallel to the blade surface, could be somehow made to "stick" to the blade surface, then all of the kinetic energy would be transferred to the rotating blade. However, since the molecule does not "stick" to the blade surface, it leaves only part of its kinetic energy and consequently, turbine systems are designed with a number of stages for successively absorbing the energy of the stream. These constructions are expensive. Another characteristic of turbine systems is that very large velocities of the gas stream are required to transport a useful rate of power because of the low density of the gas stream. Consequently,the turbines are characterized by much larger rotational velocities than with other types of engines such as the internal combustion engines. Furthermore, the high velocities go hand in hand with a requirement for higher operating temperatures which generally requires the use of more expensive materials and designs in which heat dissipation is an important consideration.

In order to avoid many of these problems, particularly complexity of design, the "vaneless" turbine was introduced around the beginning of the twentieth century. The vaneless turbine is simply a stack of disks rotatably mounted and closely spaced from one another on a common axis in which a gas stream from a nozzle is directed generally

tangentially in the space between the disks. The frictional drag of the stream of gas across the surfaces of the disks causes the disks to rotate. In contrast to the impulse type of turbine having blades, the greater the frictional force of the gas stream against the disk surfaces, the greater will be the rate of transfer of kinetic energy from the gas stream to the rotating disk and, hence, the greater will be the efficiency of the turbine. In fact, the limitation of efficiency of the disk turbine is the limitation of the magnitude of friction between the gas stream and the disk surface and the length of the path. Another inherent limitation is the low density of the gas stream requiring that fast velocities (implying large temperature of the gas stream) is required for effective energy carrying capacity.

In summary, the efficiency of the typical impulse turbine is limited by the amount of work required to compress the gas for entry into the compression chamber and by the energy losses due to friction of the gas passing through the nozzle and turbulence of the gas passing through the rotating section. The efficiency of the typical vaneless type of turbine system is limited by the energy required to compress the gas prior to in a combustion chamber, the limit on the frictional interaction between the gas stream and the walls of the disk coupled with the limited path length of the gas stream across the disk surfaces before discharge of the gas stream to the environment.

For the purposes of this specification, it is useful to review the action of the steam cleaner which is well known in the market place. the steam cleaner includes a reservoir of water, a heater for heating the water and a nozzle that directs combination of steam and water droplets against a surface to be cleaned. The device uses steam expansion to propel water

droplets at near the boiling temperature of water at a considerable velocity.

In the typical steam cleaner, water is heated to 325°F in a pressure range between 90 to 250 psi. Water heated to 325 degrees remains liquid at any pressure over 80 psi. (the saturated pressure of steam at that temperature. When water that is pressurized greater than 80 psi and heated to 325 °F passes through the nozzle thereby suddenly reducing the pressure, the water is suddenly cooled to 212 °F by vaporizing a portion of its volume (5 to 15%) to steam. The steam vapor, formed in an appropriately designed nozzle including an expansion nozzle placed past the pressure orifice, propels and directs the water as droplets from the mouth of the nozzle.

When water vaporizes, it expands to 27 times its former volume. This expansion is directed by the conical steam nozzle so that the nozzle serves as a propulsion chamber. The expansion nozzle both creates an explosive effect and directs the energized water droplets.

There are two types of steam cleaners: "vapor" cleaners and "hydraulic pressure combination"cleaners (HPC).

The vapor cleaner relies almost entirely on vaporization in the expansion nozzle for propulsion of the cleaning solution. The pump generally produces only enough pressure (about 80 psi) against the solution to keep it from boiling. in the coil.

The HPC cleaner operates in the range 150 to 250 psi. At this greater pressure, a smaller

fraction of water "flashes" to steam but the higher pressure adds the additional energy to the water droplets. Typically, 5 to 7 % water flashes to steam in a HPC cleaner. The size of the water droplets decreases as the size of the pressure orifice on the nozzle is decreased. The larger water droplets create more impact on the surface being impinged by the water.

SUMMARY OF THE INVENTION:

It is an object of this invention to overcome disadvantages of the turbine with vanes in which losses are introduced by the requirement to compress the gas entering the combustion chamber, by frictional losses of the gas passing over the stationary surfaces of the nozzle section, and by the limitation not to exceed the critical pressure drop across the turbine blades. It is a further objective to overcome the limitations of the vaneless turbine caused by slippage at the boundary layer between the gas stream and the surface of the disks thereby reducing the amount of kinetic energy that can be transferred from the stream to the disks for a fixed length of path of the stream over the disk surfaces.

This invention is directed toward a stack of disks spaced close to one another on a rotatable shaft (a vaneless turbine) in which the high velocity media directed tangentially through the spaces between the disks is a stream of high velocity liquid droplets propelled according to the principles of the steam cleaner.

In the general case, the working fluid is a liquid having a boiling temperature at atmospheric pressure that is close to the temperature of te environment.

The small amount of liquid that is converted to gas (about 5 %) passes from the space between the disks through an exit being an opening in the tubular shaft that permits the gas to pass through the shaft and be recirculated back through the system. The propelled liquid droplets are collected on the surface of the disks so that all of the kinetic energy is converted to kinetic energy of the rotating disks. As liquid is condensed on the disk surfaces, it flows by centrifugal force to the rim of the respective disk where it forms a pool of liquid that rotates with the disks until it exits through an exit port at the periphery of the disks. The exit port at the periphery of the disk directs the liquid through a special valve of this invention back to the reservoir for recirculation. Pressure of the returning liquid generated by the centrifugal force of the pool of liquid at the rim of the disks aids in returning the energy depleted liquid through the special valve from the stack of disks back to the reservoir.

According to the special valve embodiment, the work generated by admitting a volume of liquid from the reservoir at high pressure to the expansion nozzle at low pressure is used to force the same volume of energy depleted liquid from the turbine housing to the reservoir.

The amount of energy supplied to the system is equal to the thermal energy generated by

the burning fuel which heats the liquid in the reservoir. The useful energy produced by the system equals work supplied by the rotating shaft of the turbine. The energy dissipated by the system is determined by:

1. the heat of condensation of the liquid being about 5% of the total liquid current ejected into the turbine. This energy loss can be minimized according to the efficiency of the design to circulate the energy of condensation back into the system.

2. the frictional energy of the stream of liquid constituting the boundary layer at the interface of the outer housing and the liquid. This surface area is very small compared to the surface of the disks.

3. the efficiency of design in using as large a fraction as possible of the heat of burning the fuel for heating the liquid. This can be increased, for example, by warming the air supplied to burn the fuel using the heat of condensation of the fuel.

BRIEF DESCRIPTION OF THE DRAWINGS:

Fig. 1 shows a schematic of the invention.

Fig. 2 shows the action of two rotary punps coupled togerther. (coupling not shown)

DESCRIPTION OF AN ILLUSTRATIVE EXAMPLE

Turning now to a discussion of the drawings, Fig. 1 shows a mechanical schematic of the invention including a turbine 11 being a rotatably mounted stack of closely spaced disks 10 enclosed in a housing 12. In fig. 1, the housing 12 is partially cutaway to show the disks 10. Gas S (vaporized working fluid) is directed through a nozzle 14 tangentially into the space between the disks 10 thereby turning the disks 10. As the vaporized working medium condenses on the surfaces of the disks, it flows toward the periphery of the disks (by centrifugal force) and is guided by the housing 12 to flow out of exit port 16 as liquid. The liquid W flows through conduit 18 to reservoir 17 where it is reheated and returned to the nozzle 14. A pump 20 is shown connected to the conduit 18 near the entry port and another pump 22 is shown connected to the conduit near the nozzle. Fluid flows into reservoir 17 where is heated by heat source 24. The pumps serve the function of controlling the flow of liquid through the conduit 18 and isolate the conduit 18 from the nozzle 14 and turbine 10 so that required critical pressure is generated in the reservoir 17 by heat while the pressure in the turbine acquires a value corresponing to the liquid at the tempoerature of the surrounding environment. Not shown is pumps 20, 22 coupled to the turbine shaft. and to one another so that the amount of working fluid forced into the high pressure region by one pump is released from the high pressure region by the other pump.

Entry pump 20 at the entry end of the turbine requires "pump" energy to deliver a given volume of liquid W (condensed vapor) from the turbine environment (where the temperature of the working fluid is ambient and the vapor pressure of the liquid

corresponds to the ambient temperature) to the conduit 18. The "pump" energy required to drive pump 20 is derived from fluid forcing pump 22. Pump 22 ideally generates an equal amount of energy to deliver an equal amount of liquid from the conduit 18 (where pressure is high) to the turbine where pressure is ambient. Since both pumps are coupled to one another through the turbine shaft, under ideal conditions, there is no energy required to operate the combination of pumps. This is an advantage over the typical gas driven turbine where work is required to compress the gas entering a combusiton chamber.

In the event the that there is not one-to-one correspondence between the energy required by pump 20 and the energy delivered by pump 22, then turbine 10 is coupled to pump 20 (coupling not shown in fig 1) and the turbine 10 is "cranked" in order to start the turbine rotating.

The liquid at critical pressure that is ejected from the from the nozzle flashes to a mixture of gas (about 5%) and liquid droplets. The more dense liquid W collecting on the disks flows away from the turbine shaft 26. The working fluid, that has evaporated, is directed toward the turbine shaft 26 where it escapes through openings (not shown) in the shaft out of the end of shaft 26 and through a conduit 28. Conduit 28 is in thermal contact with air-fuel supply conduit 30 thereby warming the air and fuel before the fuel is burned at burners 32 to heat the working fluid in conduit 18. The prewarming of the air and fuel in conduit 18 effects an additional energy serving in terms of increasing the heat of combusition of the fuel.

The turbine is turned by the jet of the liquid droplets impinging and collecting on the disk surfaces as discussed above. The effect of slippage that characterizes state of the art vaneless turbines propelled by a gas stream is avoided. The problem imposed by the phenomenon of "critcal pressure" that characterizes impulse and reactive turbines having vanes is avoided.

Figs. 2A-D illustrate the ation of tworotarty pumps 20. 22 illustrating constant volume of heated working fluid as it is pumped through the reservoir.

Various fluids may be used to drive the turbines. These may include ammonia or freon which would provide the means to operate at a lower temperature.

A particular advantage in improved efficiency is gained by selecting a fluid having a boiling temperature that is a little above room temperature and operating the system between between boiling temperature and the critical temperature. The critical temperature is the temperature at which no energy (heat flow) is required to convert the medium from the liquid state to the gaseous state. Therefore, all of the enrgy of expansion from liquid to gas is converted to kinetic energy of the remaining liquid phase. The liquid phase will continue to boil off liquid until its temperature drops down to the boiling temperature which will be the temperature of the vanes and housing. But since this lower temperature is close (a little above) to the temperature of the environment, there will be only negigle loss of thermal energy to the enviornment so that the net loss of energy either due to phase change or conduction of heat to the environment is minimized.

An alternative approach is to have a closed system (i.e., closed turbine housing) and select a woring liquid whose boiling temperature is below ambient temperature. Under this condition, the lower pressure of the working fluid will depend on the temperature of the environment and there will be no heat flow from the working fluid to the environment. The temperature of the fluid impinging on the disks will depend on the length of the discharge tube direceted at the disks and the rate at which liquid is delivered to the discharge tube.

The following table lists fluids which have a boiling temperature a little above the environment and a critical temperature within a practical range for operting the invention:

	boiling T^{o}C	critical T ^{o}C	critical P (atm)
carbon disulfide---------	46.25	273	75
Pentane------------------------	36	196	3.64 P/mP$_a$

The conduit line 28 communicates with a reservoir 31 to store liquid under pressure for the purpose of permitting adjustment of operatng conditions. In this version, if a working fluid is selected having a boiling temperature (at one atm) that is below the temperature of the environment, then the pressure in the turbine housing will rise to a value where the temperature of the condensate equals the temperature of the environment. and there will be no loss of energy due to heat flow to the environment.

Under ideal conditions of construction and operation of the system, where there is no extraneous heat loss as characterizes state of the art turbines and internal combusition engines, and the only enregy delivered by the system is through the turbine shaft, the present ingvention is a very efficient engine.

In summary, advantages of the recirculating turbine of this nvention are listed as follows:

1. No energy of compression is required. 95% of the working fluid remains liquid throughout the entire cycle.
2. No loss of heat occurs at the low temperature end of the cycle because the temperature at the low end of the cycle is close to room temperature.
3. The high temperature end of the cycle (the boiler) is at the critical temperature so that no loss of heat is involved due to latent heat of vaporization.
4. The energy difference between the boiler temperature (critical temperature) goes mostly into kinetic energy of the working fluid. Only 5% of the working fluid is converted to vapor so that there is negligible requirement to give up a large amount of latent heat.
5. A wide range of options is provided for selecting a fuel for heating the working fluid.

Variations and modifications of the invention may be contemplated after reading the specification and studying the drawings that are within the scope of the invnetion.

For example, the principles of the invention apply to any one of a number of design of the turbine. In the embodiment discusssed above, the turbine included a stack of disks

mounted on a rotatable shaft. Another version is a turbine consisting of paddles mounted on the rotatable shaft. In the context of this specification, a turbine will be understood to mean a rotatable shaft having any one of impeller members (paddles, or disks) mounted on the shaft arranged to catch a stream of working fluid direced against the paddles or disks. A turbine system will be understood to include a turbine, a working fluid means for heating the working fluid by a heat source, and the plumbing associated with directing the working fluid against impeller members of the turbine

I therefore wish to define the scope of my invention by the appended claims.

I claim:

1. A tubine system comprising:

a housing;

impeller member mounted on a rotatable shaft; inside said housing;

a resrvoir means for holding a working fluid;

said reservoi means being air tight.

said reservoir means exposable to a source of heat whereby working fluid in said reservoir is heated to an elevated temperature;

exit conduit arranged to conduct working fluid from said reservoir into said housing against said impeller member;

entry conduit for conducting working fluid from said housing into said resrvoir;

exit pump means for pumping working fluid from said reservoir through said exit conduit to said housing ;

entry pump means arranged for pumping working fluid from said housing through said entry conduit to said reservoir;

said exit pump means coupled to said entry pump means in an aoperable arrangement to provide that rate at which said entry pump means delivers working fluid from said housing to said reservoir equals rate at which said exit pump delivers working fluid from said resrvoir to said housing;

a region within ssaid turbine system between asid entry and exit pumps and including said reservoir bein closed providing that said region is heaeted to an elevated temperature and pressure when heat from said source is applied to working fluid in said reservoir.

2. The turbine system of claim 1 wherein said elevated temperature is the critical temperature of said working fluid.

3. The turbine system of claim 1 wherein said working fluid is carbon disulfide.

4. The turbine system of claim 1 wherein said working fluid is pentane.

5. The turbine system of claim 1 wherein said impeller members is a stack of disks.

6. The turbine system of claim 1 wherein said housing is exposed to ambient conditions providing that said housing is at a temeperature close to atmospheric temprature.

7 A tubine system comprising:

a housing;

a stack of disks mounted on a shaft, said shaft being rotatably mounted;

a quantity of working fluid;

a resrvoir means for holding said working fluid;

said reservoir means being gas tight.

heating means for heating said working fluid in said reservoir to a critical temperatture of said working fluid;

exit conduit arranged to conduct working fluid from said reservoir into said housing against said impeller member;

entry conduit for conducting said working fluid from said housing into said resrvoir;

exit pump means for pumping working fluid from said reservoir through said exit conduit
to said housing ;

entry pump means arranged for pumping working fluid from said housing through

said entry conduit to said reservoir;

said exit pump means coupled to said entry pump means in an aoperable arrangement to provide that rate at which said entry pump means delivers working fluid from said housing to said reservoir equals rate at which said exit pump delivers working fluid from said resrvoir to said housing;

a region within said turbine system between asid entry and exit pumps and including said reservoir being closed permitting that fluid in said region when heaeted to a critical temprature of said working fluid, pressure in said reservoir is increased ro a critical pressure.

ABSTRACT

A turbine system including a turbine and a reservoir for working fluid and a turbine. the reservoir is closed so that the workng fluid is heatable up to the critical temperature of the working fluid.   An exit pump pumps superheated working fluid from the reservoir onto the impellers in the turbine. An entry pump pumps working fluid from the turbine back to the reservoir.   The reservoir is closed (gas tight) permitting heating the working fluid in the reservoir up to the crtical temperature and criical pressure of the working fluid. The exit and entry pumps are coupled together and arrnged such that the rate at which flid enters the reservoir equals the rate that the working fluid leaves the reservoir. By raising the working fluid to in the reservoir in the liquid stae, loss of energy of vaporization is substantially aboided.   By maintaining equal rates of charrge and discharge of fluid into and out of the reservoir, loss of energy due to compresion is avoided.

Fig. 1

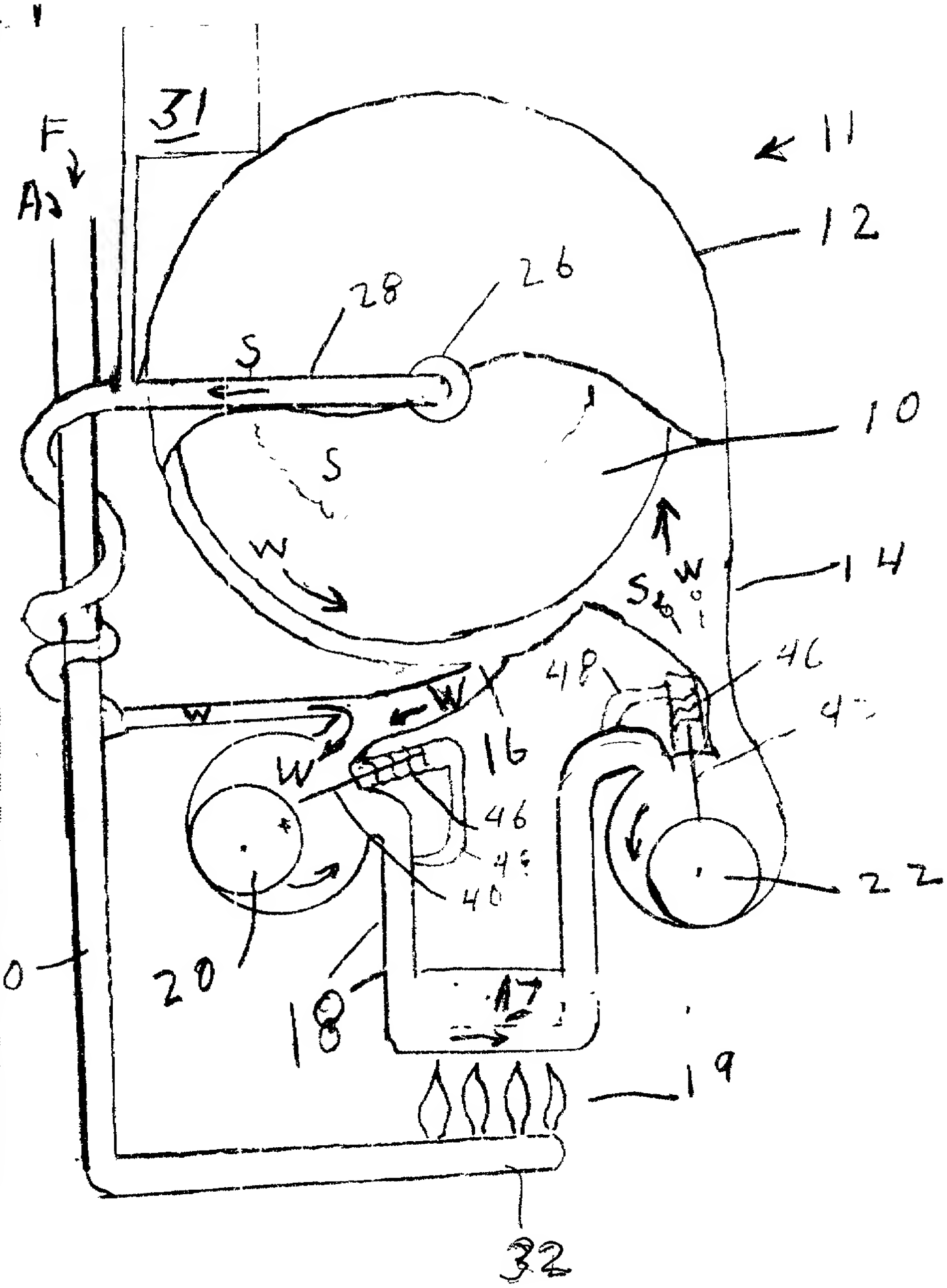


Fig. 2A

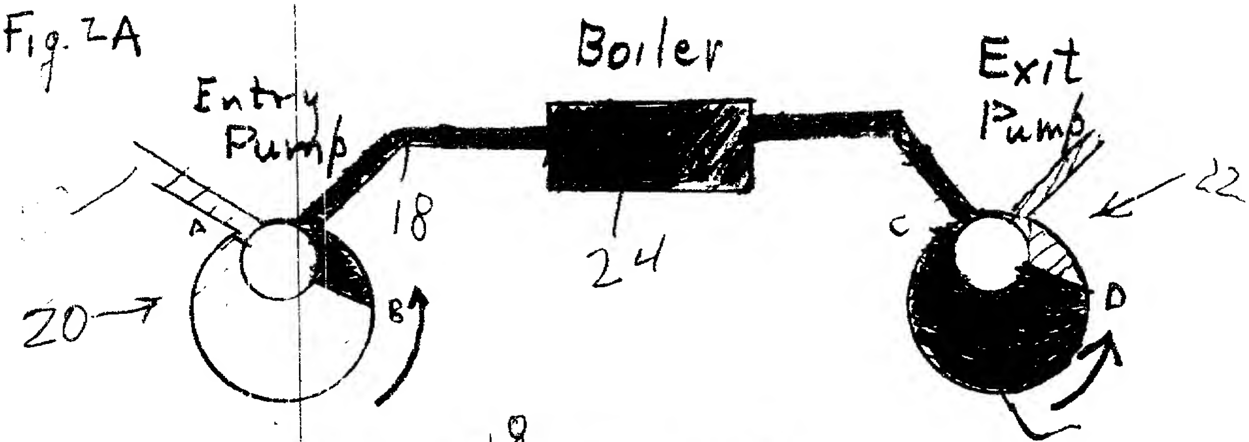


Fig 2B

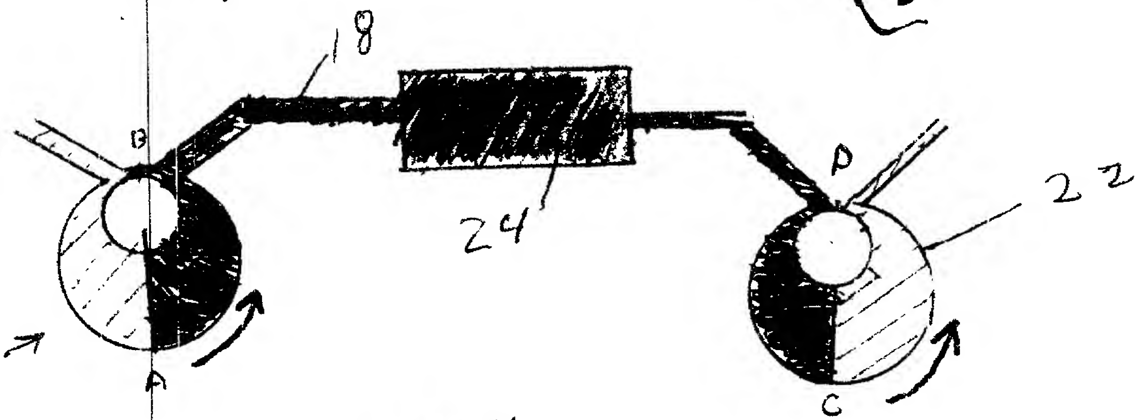


Fig. 2C

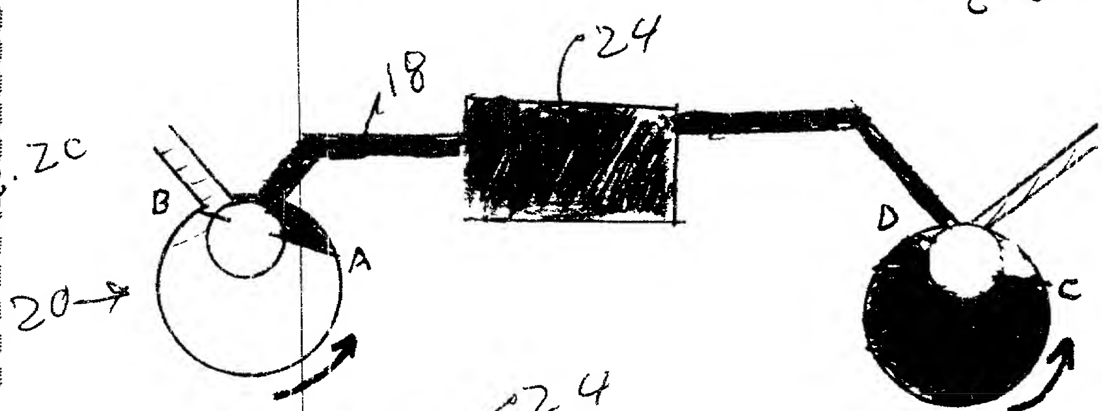
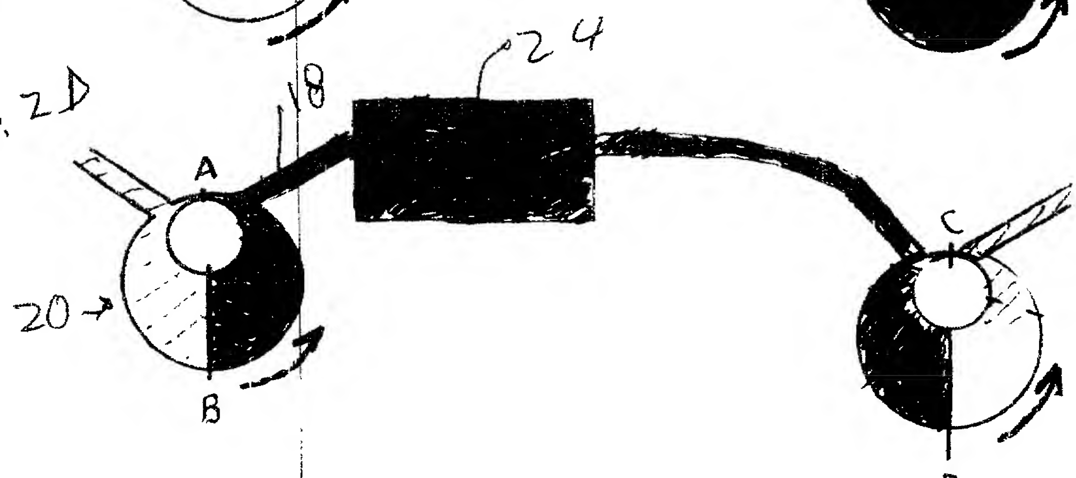


Fig. 2D



Hi Pressure

Lo Pressure

** ≫Please type a plus sign (+) inside this box → [+]

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION

☐ Declaration Submitted with Initial Filing OR ☐ Declaration Submitted after Initial Filing

Attorney Docket Number	RS50
First Named Inventor	A SMITH
COMPLETE IF KNOWN	
Application Number	
Filing Date	
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

RECIRCULATING MEDIUM TURBINE

(Title of the invention)

the specification of which

☒ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) ______ as United States Application Number or PCT International

Application Number ______ and was amended on (MM/DD/YYYY) ______ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119 (a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365 (a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	Certified Copy Attached? NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	
		☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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DECLARATION — Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: ☐ Customer Number ______ → Place Customer Number Bar Code Label here
OR
☐ Registered practitioner(s) name/registration number listed below

Name	Registration Number	Name	Registration Number
Robert S. Smith	31305		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to ☐ Customer Number or Bar Code Label ______ OR ☐ Correspondence address below

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])				Family Name or Surname	
ROBERT SAMUEL				SMITH	
Inventor's Signature	Robert Samuel Smith			Date	10-24-00
Residence: City	SAN JOSE	State	CA.	Country	USA	Citizenship	USA
Post Office Address	1263 EMORY ST.				
Post Office Address					
City	SAN JOSE	State	CA	ZIP	95126	Country	USA

☐ Additional inventors are being named on the ____ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.